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(54) **BACKLIGHT MODULE AND LIQUID CRYSTAL DISPLAY DEVICE**

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(52) **U.S. Cl.** **345/102**; 345/87; 345/89
(58) **Field of Search** 345/102, 55, 87, 345/88, 659, 75.2, 89; 315/169.3, 169.4; 349/71; 313/495

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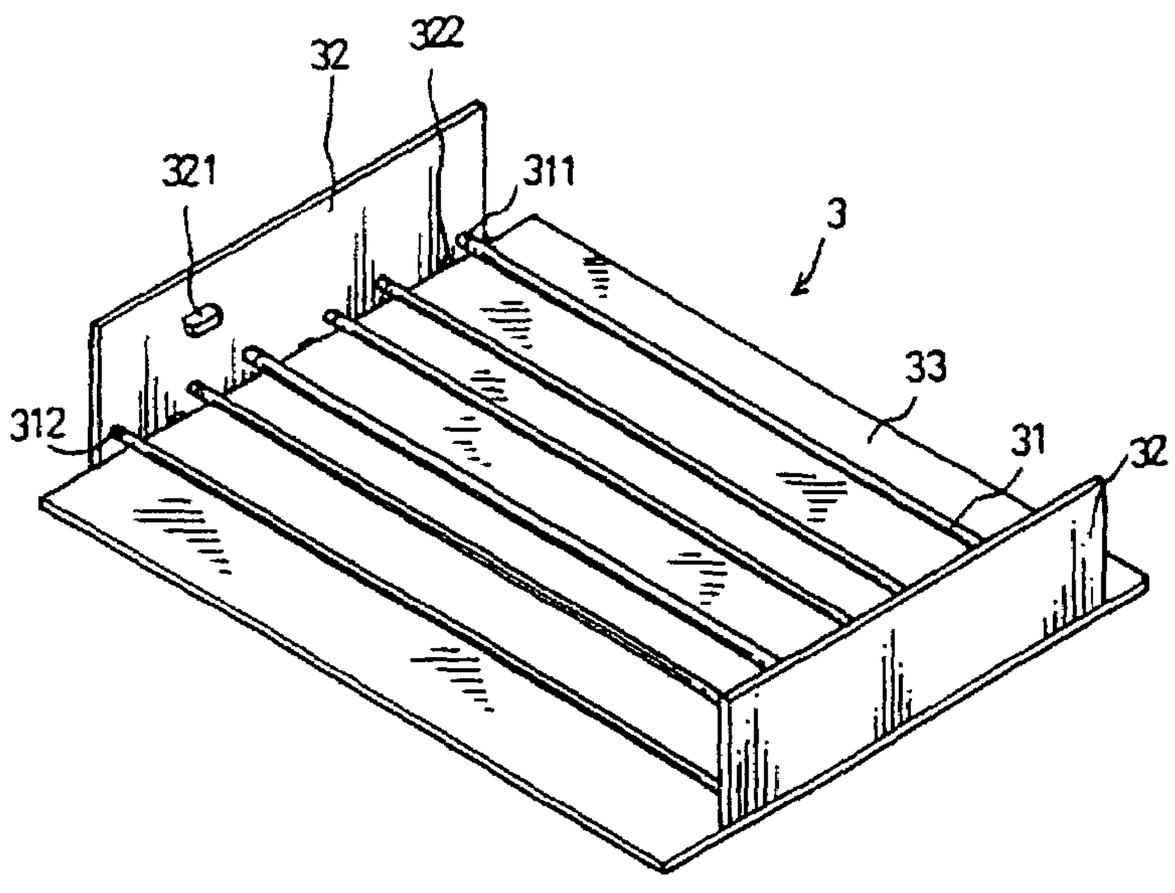
(57) **ABSTRACT**

The present invention mainly relates to a backlight module for use in a liquid display device. The backlight module comprises a plurality of lamps located above a reflecting plate. Each lamp comprises two ends while each end comprises an electrode. Voltage required for the lamps is provided by at least one inverter board located at least one of two sides of the reflecting plate; wherein the electrodes electrically connect to the at least one inverter board directly. Sizes of the backlight can be reduced in the present invention. Furthermore, costs of material and manufacturing are also reduced.

8 Claims, 4 Drawing Sheets



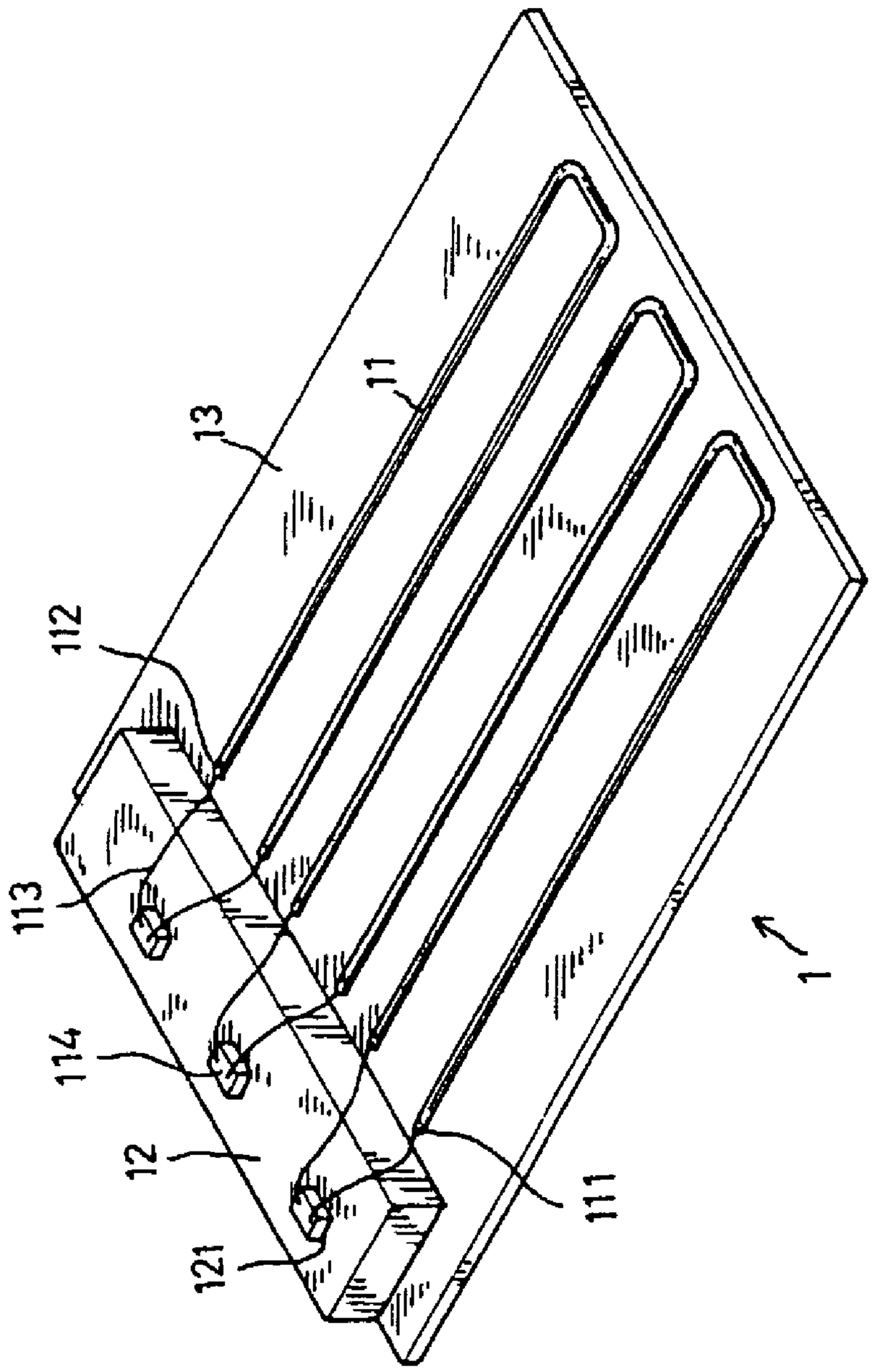


FIG. 1 (Prior Art)

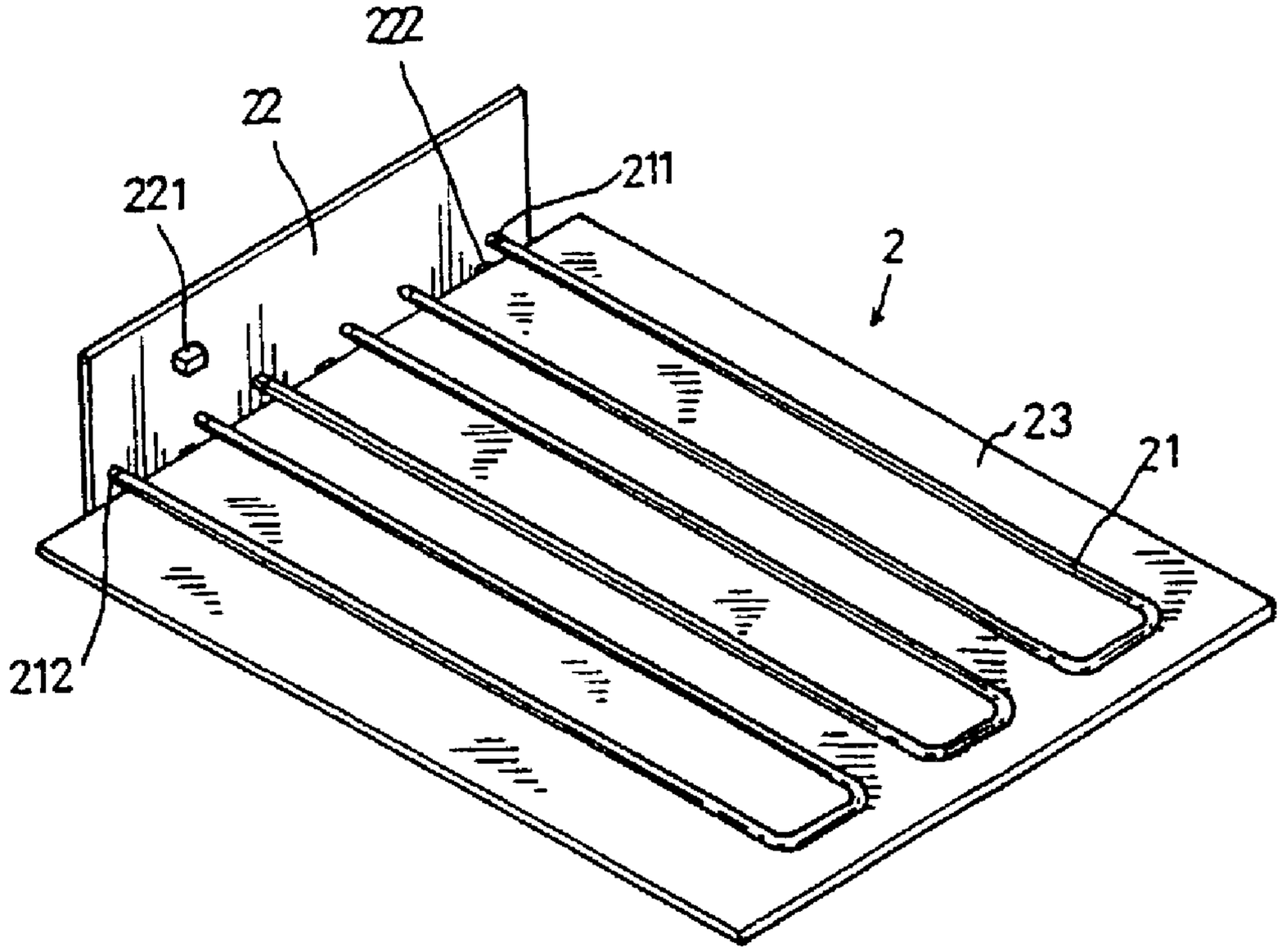


FIG. 2 a

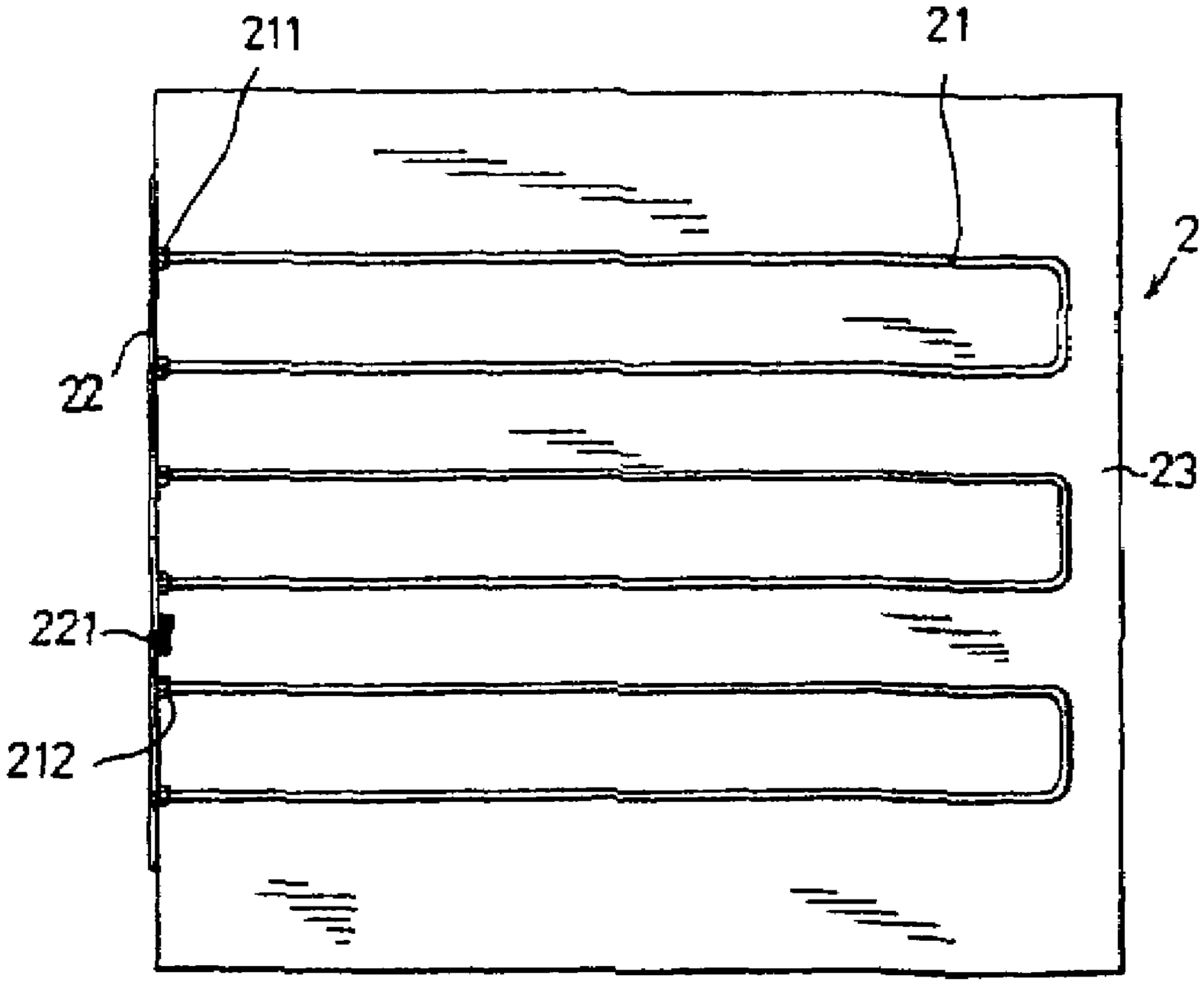


FIG. 2 b

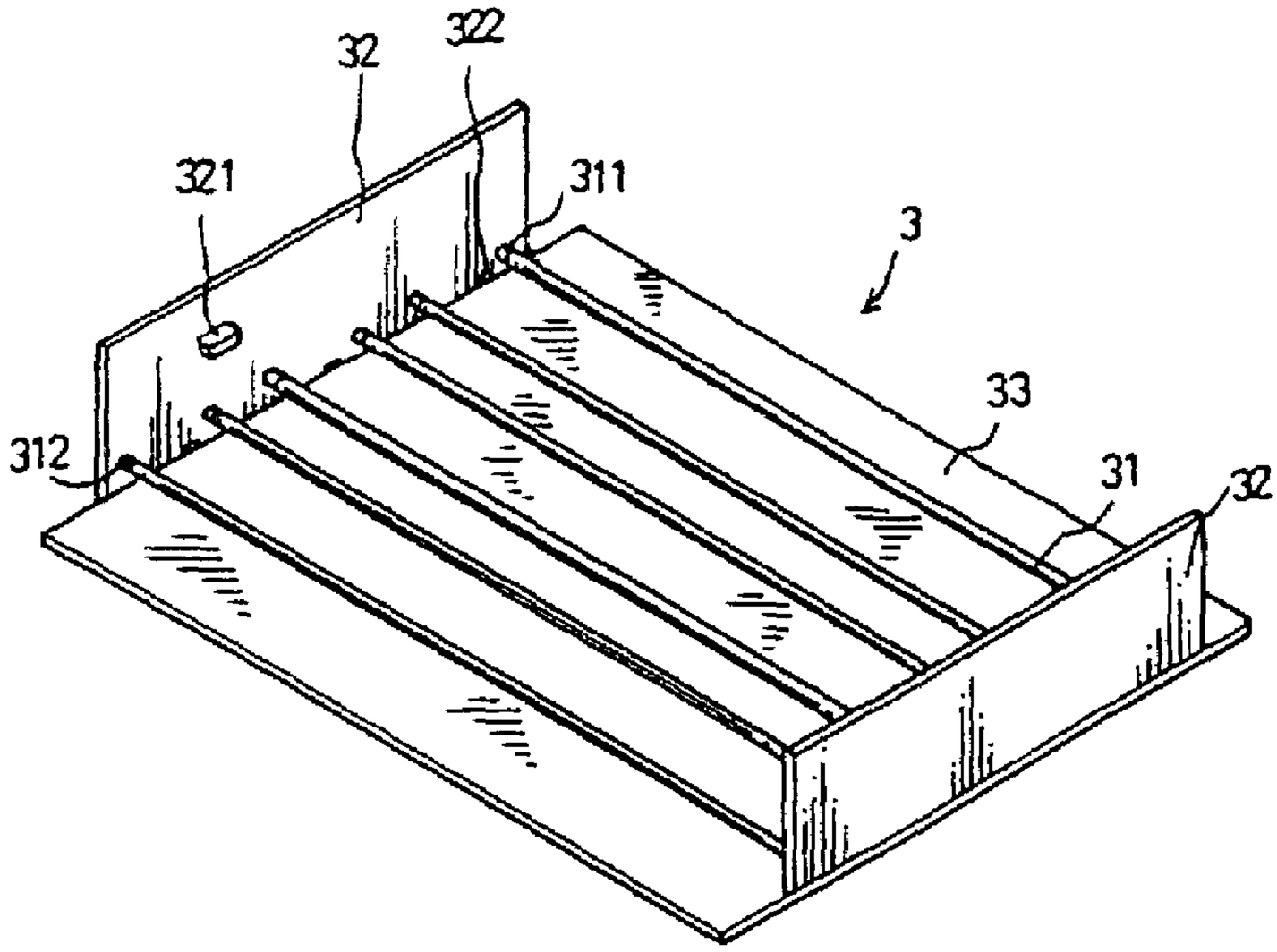


FIG. 3 a

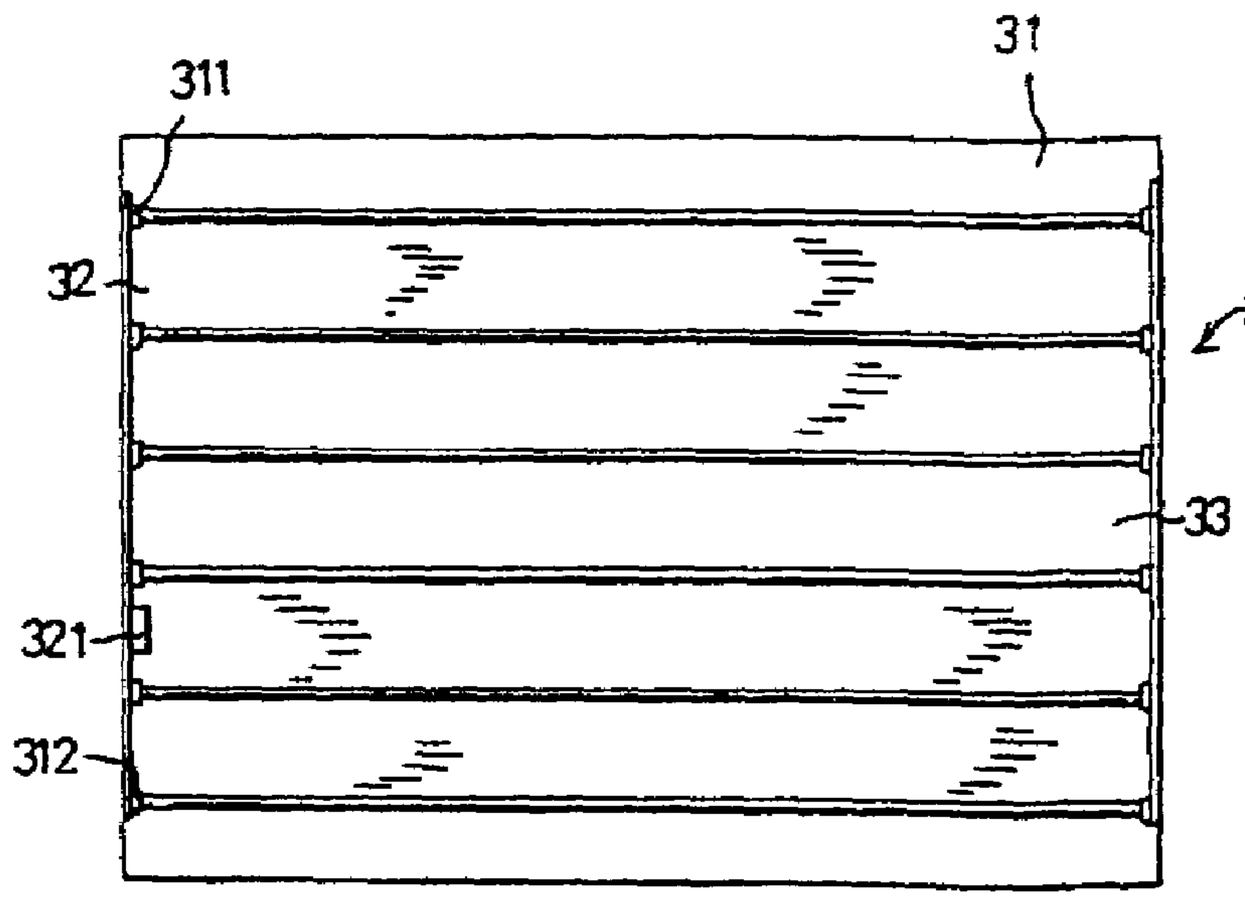


FIG. 3 b

BACKLIGHT MODULE AND LIQUID CRYSTAL DISPLAY DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention mainly relates to a backlight module used in a liquid crystal display device, more particularly, to the connections between lamps and an inverter boards in a backlight module.

2. Description of the Related Art

A typical liquid crystal display device mainly comprises a liquid crystal panel. Because the liquid crystal panel does not emit light itself, a backlight module is needed to provide the liquid crystal panel enough luminescence. In order to comply with consumers' requests, the backlight module is directed to reducing the weight and saving the cost.

Nowadays, there are many kinds of backlight module of liquid crystal display device used in this field; wherein a direct under type backlight module **1** is shown in FIG. **1** which comprises a plurality of U-shaped (or linear) lamps **11** disposed above a reflecting plate **13** to provide the liquid crystal panel light source. Each end of the lamp **11** is connected to a wire **113** through an electrode **111**, and the wires **113** located at the two ends of one lamp **11** are co-connected to a connector **114**. The connector **114** is further connected to an output **121** on an inverter board **12** which provides the lamp **11** voltage required for illuminating. Besides, a dielectric protecting tube **112** which isolates the high voltage electrode **111** and allows the wire **113** to extend to outside, is usually applied to the electrode **111** to protect it.

The disadvantage of the backlight module **1** is an over large size thereof. Because the inverter board **12** which lies in the backlight module **1**, connected with the lamp **11** through the wire **113** and the connector **114**, a space should be kept for receiving the inverter board **12**, wire **113** and connector **114** in an inactive area besides an active area for showing data. Therefore, the size cannot be reduced. In addition, the electrode **111** of the lamp **11** should be connected to the wire **113** first, and then the wires **113** at the two ends of the lamp **11** are connected to the connector **114** of the inverter board **12**. Short appears in connections of such complicated connecting easily and forms defects. Furthermore, costs of material and manufacturing are high as each lamp **11** is connected to the output **121** through the connecter **114**.

Therefore, the present invention is directed to developing a novel and improved backlight module by reducing the size of a liquid crystal display device and saving its cost.

SUMMARY OF THE INVENTION

One objective of the present invention is to provide a backlight module for use in a liquid display device. The backlight module comprises a plurality of lamps located above a reflecting plate. Each lamp comprises two ends while each end comprises an electrode. Voltage required for the lamps is provided by at least one inverter board located at least one of two sides of the reflecting plate; wherein the electrodes electrically and physically connect to the at least one inverter board directly. Sizes of the backlight can be reduced in the present invention. Furthermore, costs of material and manufacturing are also reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates parts of a conventional backlight module;

FIG. **2***a* illustrates parts of a backlight module according to the first embodiment of the invention, and FIG. **2***b* is a front view illustrating FIG. **2***a*; and

FIG. **3***a* illustrates parts of a backlight module according to the second embodiment of the invention, and FIG. **3***b* is a front view illustrating FIG. **3***a*.

DETAILED DESCRIPTION OF THE INVENTION

The preferred embodiments in the invention are described below.

The First Embodiment

FIGS. **2***a* and **2***b* illustrate a backlight module **2** which comprises a plurality of U-shaped lamps **21** and light emitted therefrom is reflected by a reflecting plate **23** disposed under the lamps **21** to a liquid crystal panel. Each lamp **21** comprises two ends, each including an electrode **211** inputting power to the lamp **21**, and the electrode **211** further electrically and physically connects to an inverter board **22** located at one side of the reflecting plate **23** to simultaneously provide voltage required for the lamps **21**. The inverter board **22** can deliver voltage output by a single output **221** to the electrodes **211** separately through circuits on the inverter board **22**. Besides, the inverter board **22** is disposed vertically to the reflecting plate **23** to connect the inverter board **22** directly. Preferably, the height of the inverter board **22** is less than the thickness of the backlight module **2**. In the embodiment, the backlight module **2** further comprises a back cover (not shown), and the inverter board **22** further comprises a plurality of fixing elements **222** for fixing the inverter board **22** to the back cover. Besides, a protecting tube **212** for protecting and isolating the electrodes **211** can be applied to wrap the electrodes **211** as well; wherein the protecting tubes are made of dielectric material.

The inverter board **22** vertically to the reflecting plate **23** electrically and physically connects the electrodes **211** of the lamp **21** directly. All known methods can be utilized to attain such connections, for example, welding directly, connecting the electrodes **211** and the inverter board **22** through a wire and then cutting off excess wires. Since the wires are not necessary for connecting the inverter board, it is not necessary to provide every connector an output, either. Therefore, chances of short resulting from complicated connections in the prior art are quite slim, and steps of manufacturing are simplified, too. Besides, the present invention avoids having excess wires, connectors and outputs, and has the advantage of cost control. It is a great improvement in sizes of liquid crystal display device that a minimal space of disposing the vertical inverter board should be kept in an inactive area of the backlight module and the thickness thereof is not increased. Thus, the liquid crystal display device has an advantage of small volume.

The Second Embodiment

FIGS. **3***a* and **3***b* illustrate a backlight module **3** which is similar to the backlight module **2** in the first embodiment. The backlight module **3** comprises a plurality of linear lamps **31** above a reflecting plate **33**, each lamp **31** comprising two ends, and each end electrically and physically connected to a first inverter board **32** through an electrode **311** and a second inverter board **34** located at opposite sides of the

reflecting plate **33**; wherein the inverter boards **32** and **34** stand vertically to the reflecting plate **33**, directly connecting the electrodes **311** thereby. In the embodiment, the first inverter board **32** comprises a power-supplying end **321** enabling to provide the lamps **31** voltage and electrically connecting the second inverter board **34** through wires (not shown) to separately deliver voltage to every lamp.

The connections of the inverter board and the electrode, the designs of the circuit and power-supplying end can be made by those skilled in the art, based on their specific knowledge of electronics. Besides, other elements for additional effects, for example, fixing elements or protecting tubes, can be also added into the backlight module in the invention optionally.

The present invention is suitable for all kinds of direct under type backlight module, wherein numbers and shapes of the lamp and designs of circuit in the inverter board are not limited in the disclosures of the embodiments mentioned above. Backlight modules of liquid crystal display device having a plurality of lamps electrically connected to at least one inverter board directly to make a plurality of electrodes of the lamp disposed adjacently to the inverter board are in the scope of the invention.

As embodiments of the present invention have been illustrated and described, various modifications and improvements can be made by persons skilled in the art. The embodiments of the present invention are therefore described in an illustrative but not restrictive sense. It is intended that the present invention is not limited to the particular forms as illustrated, and that all the modifications not departing from the spirit and scope of the present invention are within the scope as defined in the appended claims.

What is claimed is:

1. A backlight module for use in a liquid crystal display device comprising:

a reflecting plate;

a plurality of lamps disposed above the reflecting plate, each of the lamps comprising two ends each including an electrode; and

at least one inverter board located at least one of two sides of the reflecting plate to simultaneously provide voltage required for the lamps, wherein the electrodes electrically and physically connect the at least one inverter board directly, and the inverter board is disposed vertically to the reflecting plate.

2. A backlight module according to claim **1** which comprises an inverter board, wherein the lamps are U-shaped lamps which form the two electrodes to directly connect to the inverter board.

3. A backlight module according to claim **1** which comprises two inverter boards disposed at two opposite sides of the reflecting plate, respectively, wherein the lamps are linear lamps each of which forms the two electrodes to directly connect to the two inverter boards.

4. A backlight module according to claim **1** further comprising a plurality of protecting tubes to wrap the electrodes wherein the protecting tubes are made of dielectric material.

5. A backlight module according to claim **1**, wherein the at least one inverter board comprises at least one power-supplying end disposed thereon.

6. A backlight module according to claim **1** further comprising a back cover, and the at least one inverter board further comprises a plurality of fixing elements to fix the at least one inverter board to the back cover.

7. A backlight module according to claim **1**, wherein the electrodes are welded to the at least one inverter board directly.

8. A liquid crystal display device comprising a backlight module according to claim **1**.

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